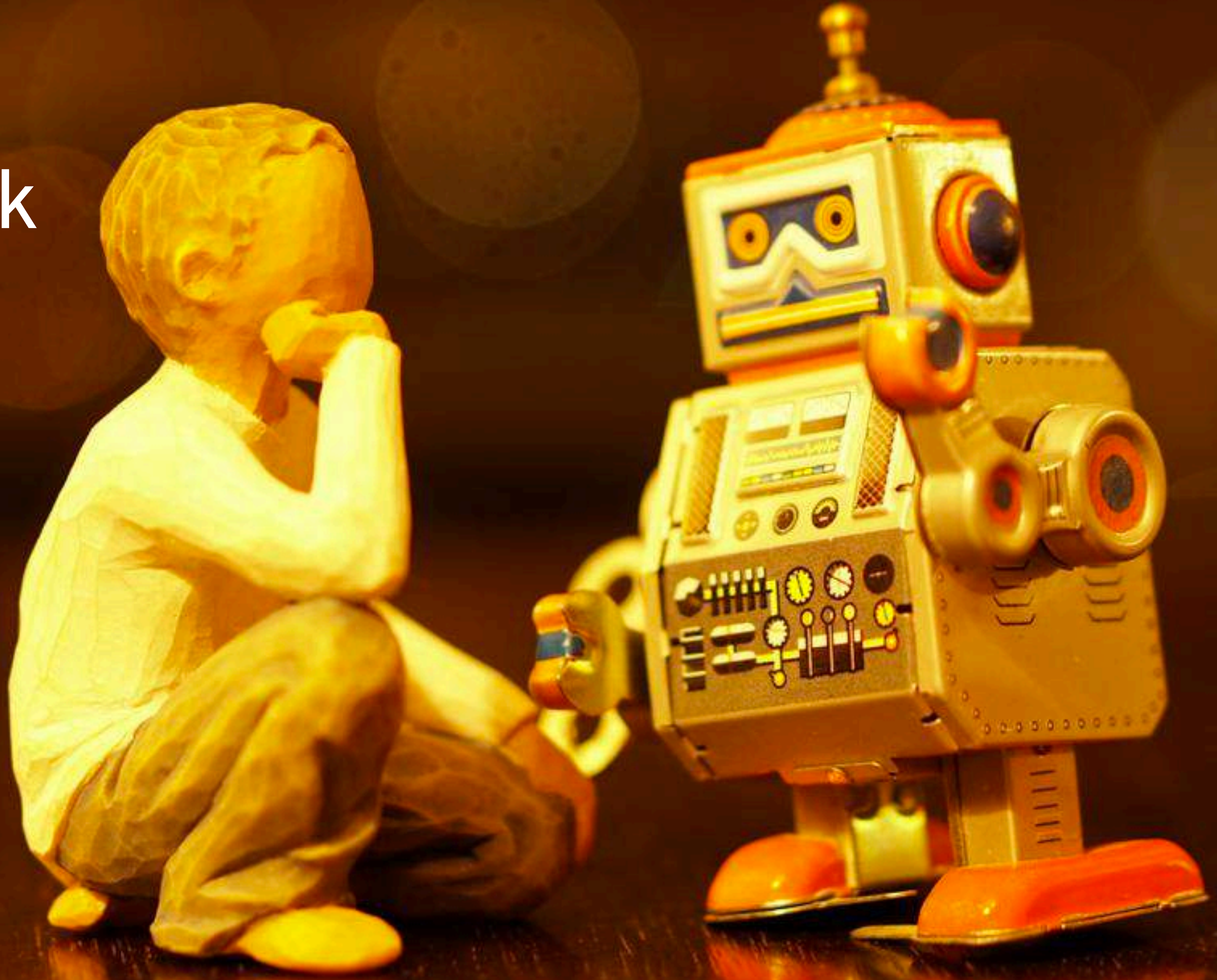
The complexity of skills and the future of work

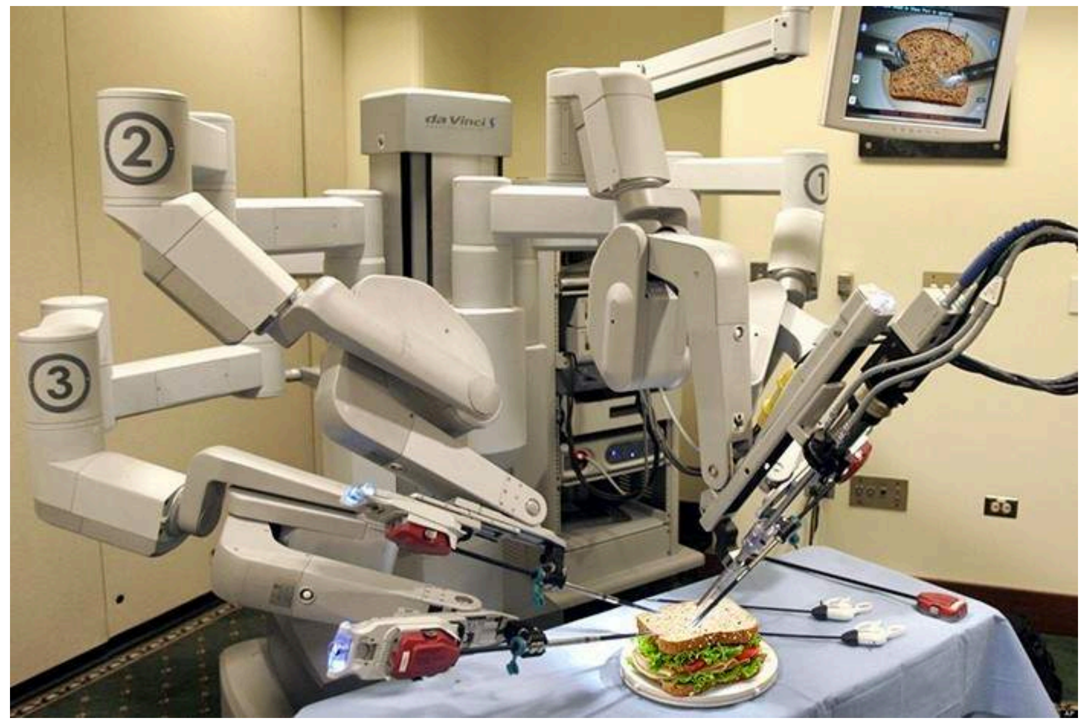
Morgan R. Frank




Brad Wilson 1 minute ago
We will soon have too many people.
REPLY
0Turbox 1 minute ago
Who sheds a tear about these jobs?
1
REPLY
feeblezak 3 minutes ago
Time for warehouse workers to unionise.
1
REPLY
BaikΦ 3 minutes ago
bye bye humans in jobs...
REPLY


Source Subject
*Challenging due to missed detections
Everybody Dance Now (arXiv:1808.07371)

Skill biased technological change



Surgeons & Robotics

Engineers & Drones

Bank Tellers & ATMs

A framework for skills, labor, and cities

- differential impact of automation
- skill & wealth disparity
- spatial career mobility

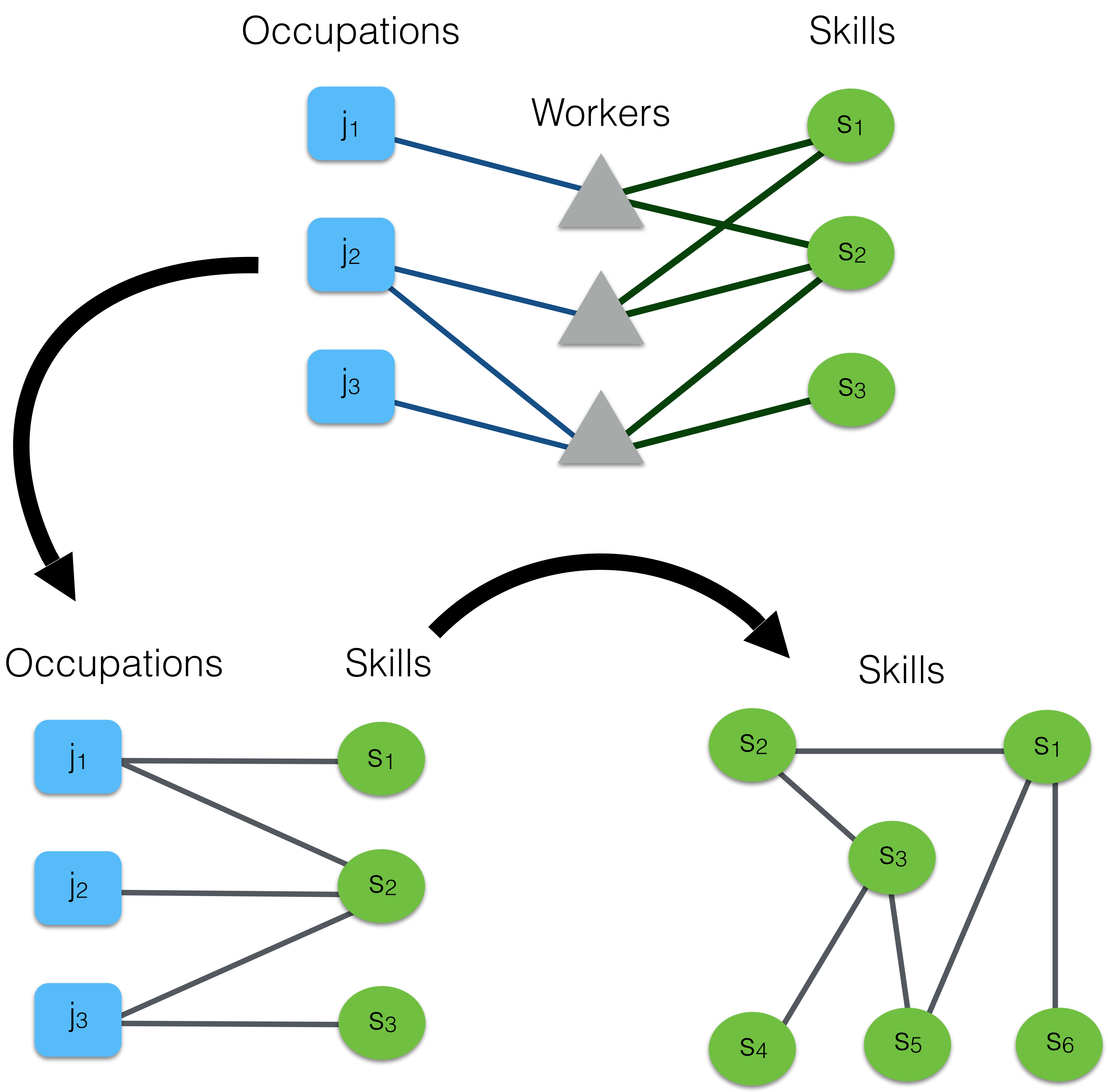
- career trajectories
- viable retraining
- job polarization

- interaction with technology
- skill complementarity
- education

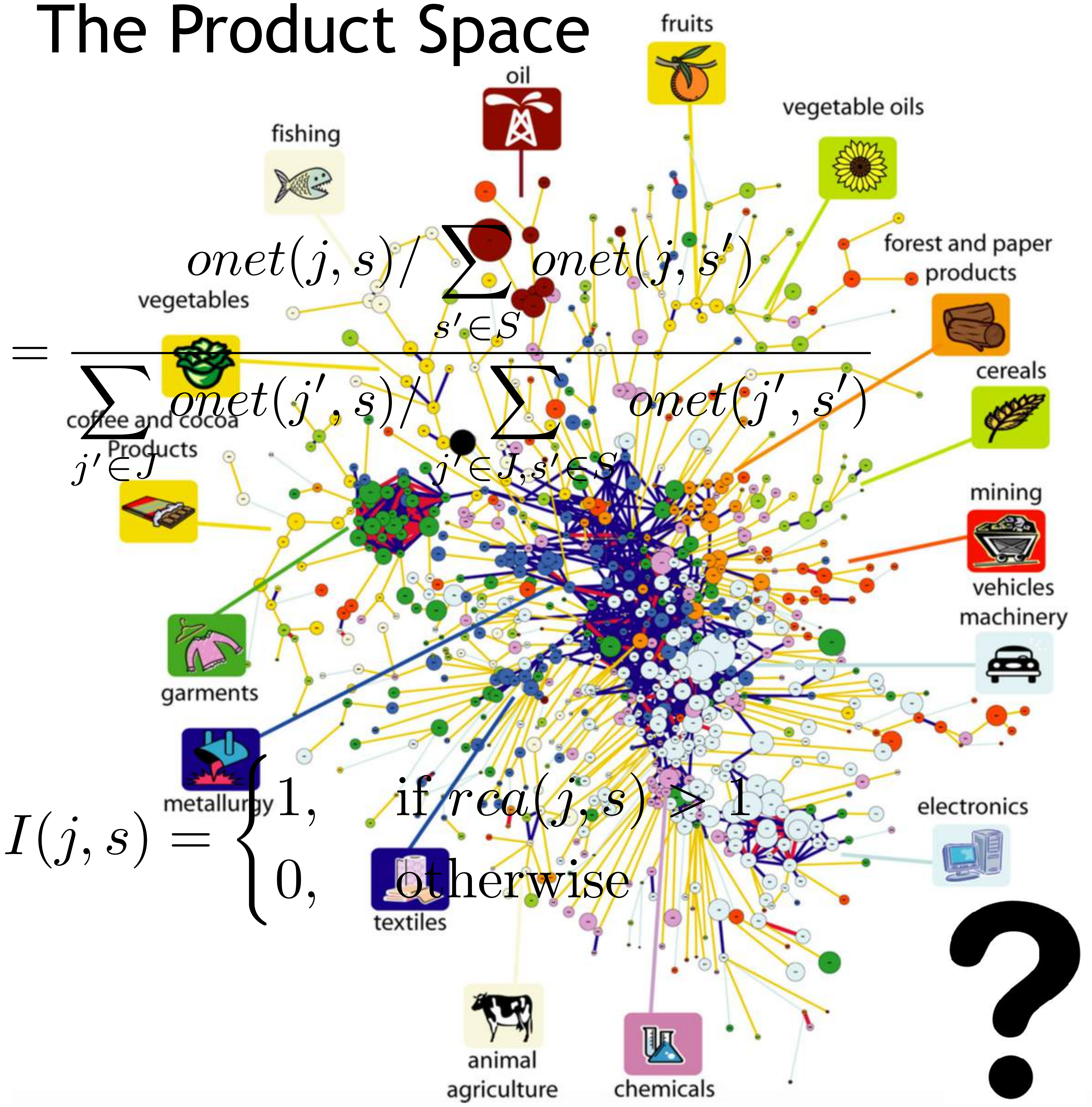
Frank et al., *PNAS* (2019)

Local Labor Markets
Occupations & Employment
Tasks & Skills
Executive
Programmer
Bartender
Persuasion
Stamina
Vision
Computer Vision
Mathematics

The structure of workplace skills



The Product Space

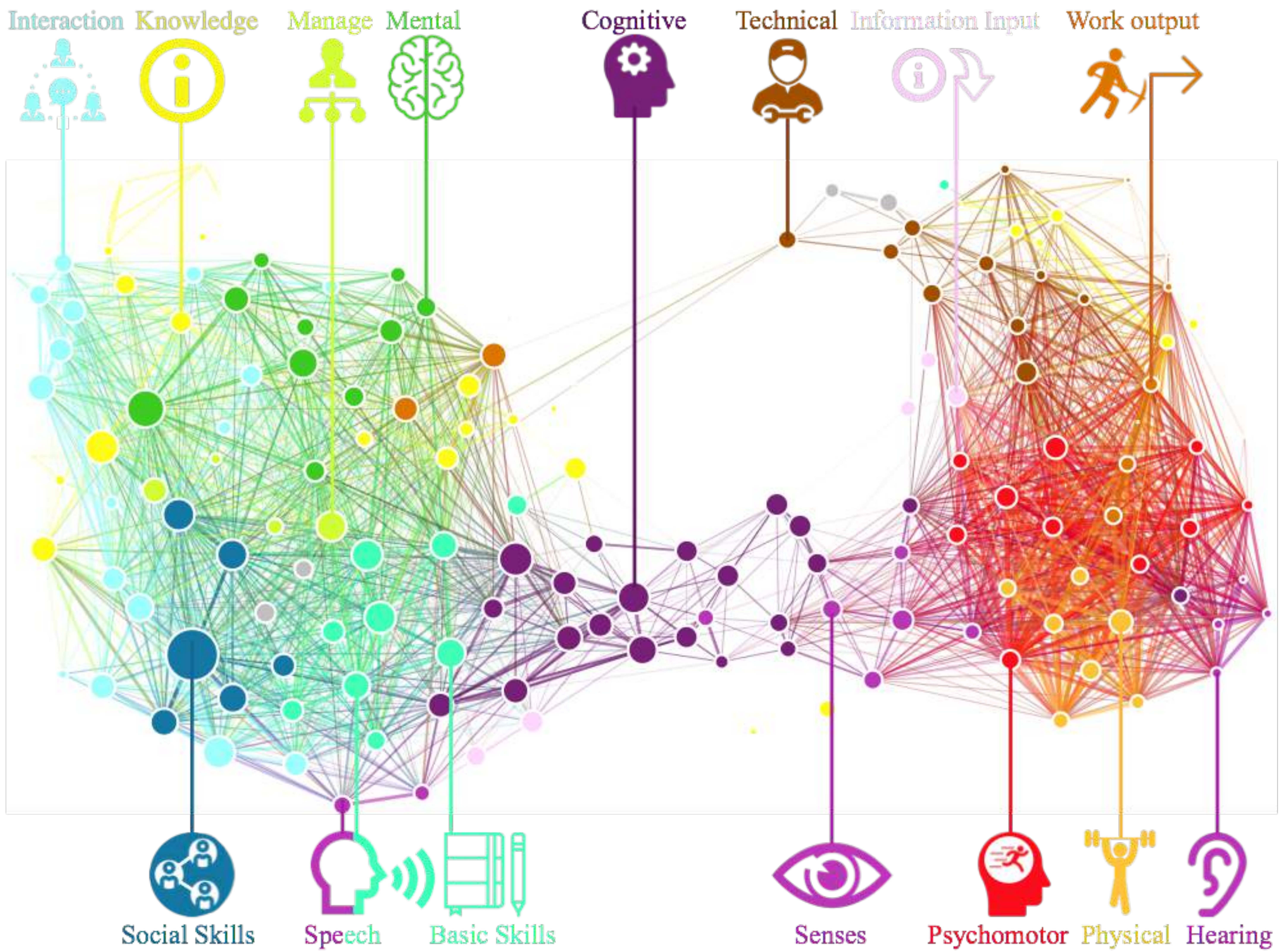


$$rca(j,s) = \frac{onet(j,s)/\sum_{s'\in S} onet(j,s')}{\sum_{j'\in J} onet(j',s)/\sum_{j'\in J,s'\in S} onet(j',s')}$$

$$I(j,s) = \begin{cases} 1, & \text{if } rca(j,s) > 1 \\ 0, & \text{otherwise} \end{cases}$$

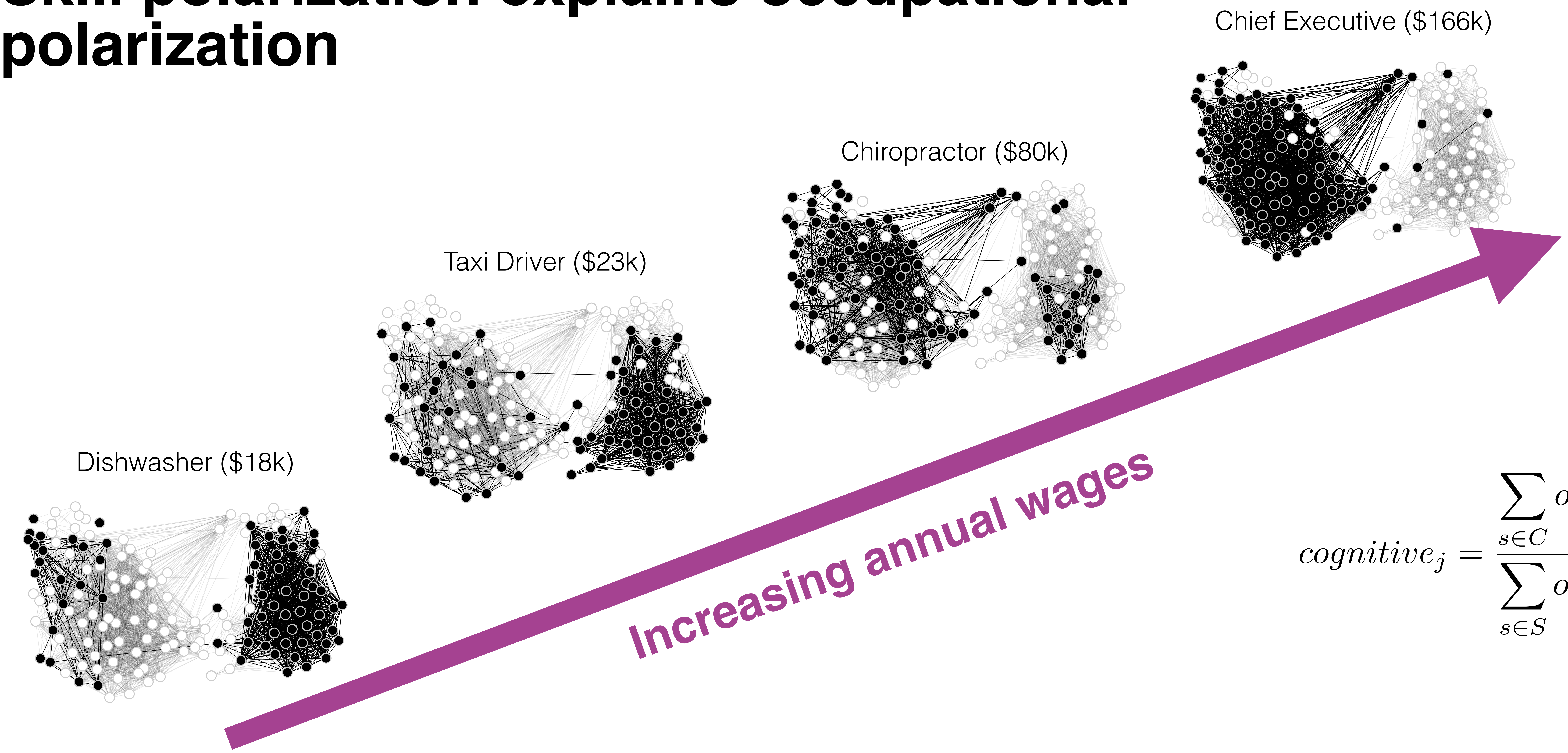
Science Advances (2018)

Unpacking the polarization of workplace skills



Science Advances (2018)

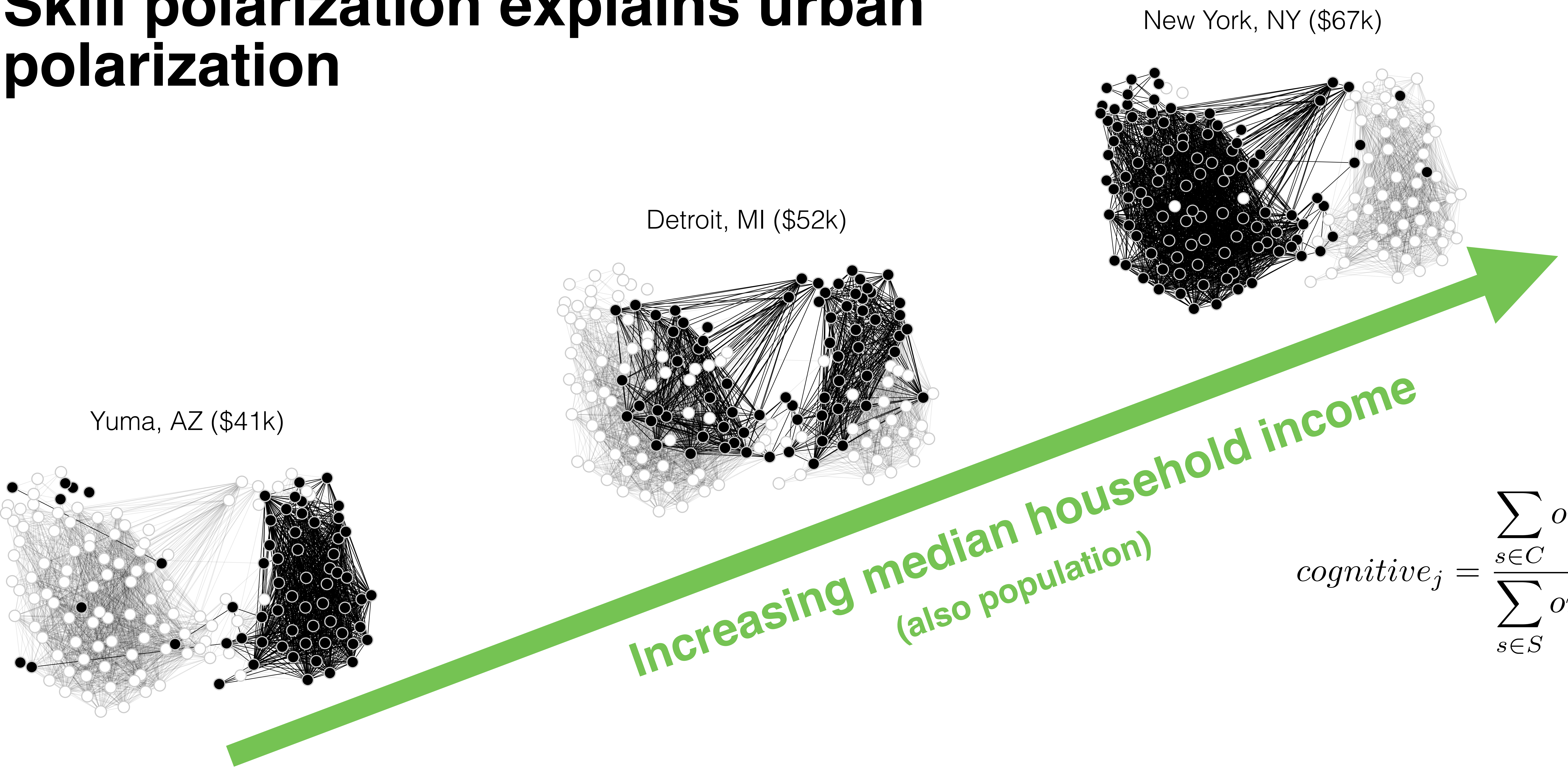
Skill polarization explains occupational polarization



$$cognitive_j = \frac{\sum_{s \in C} onet(j,s)}{\sum_{s \in S} onet(j,s)}$$

Science Advances (2018)

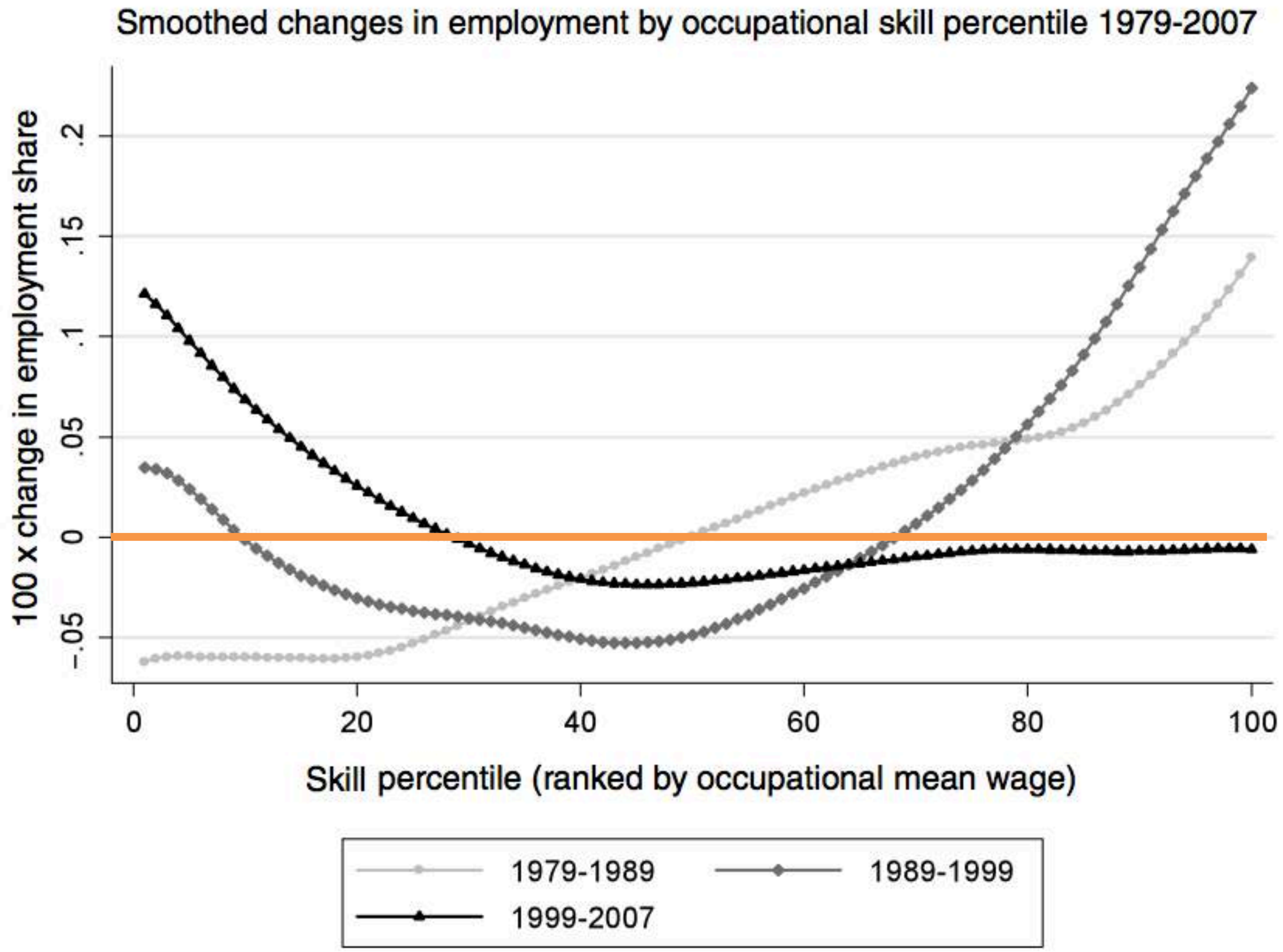
Skill polarization explains urban polarization



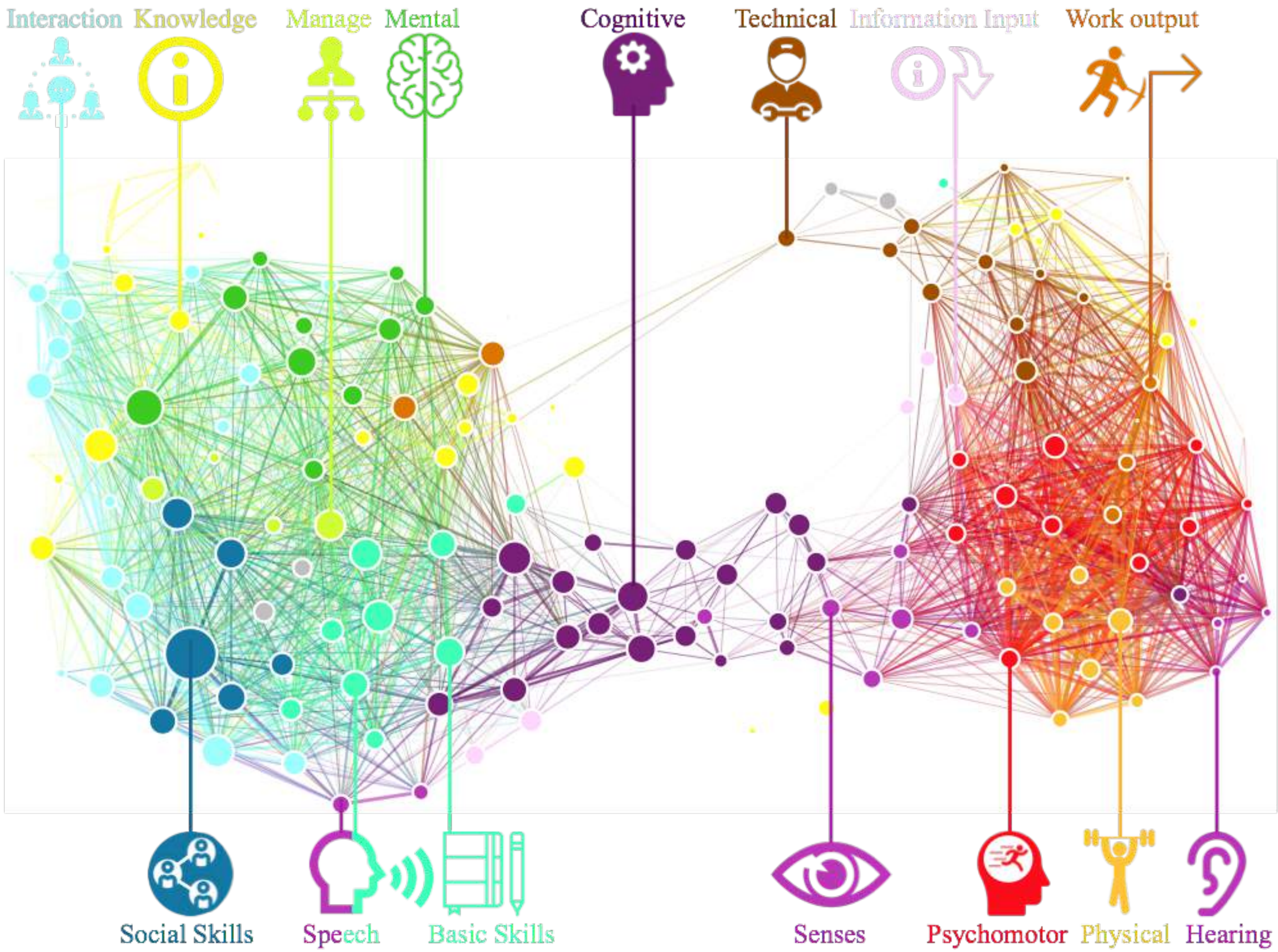
$$cognitive_j = \frac{\sum_{s \in C} onet(j,s)}{\sum_{s \in S} onet(j,s)}$$

Science Advances (2018)

Explaining low- and high-skill employment



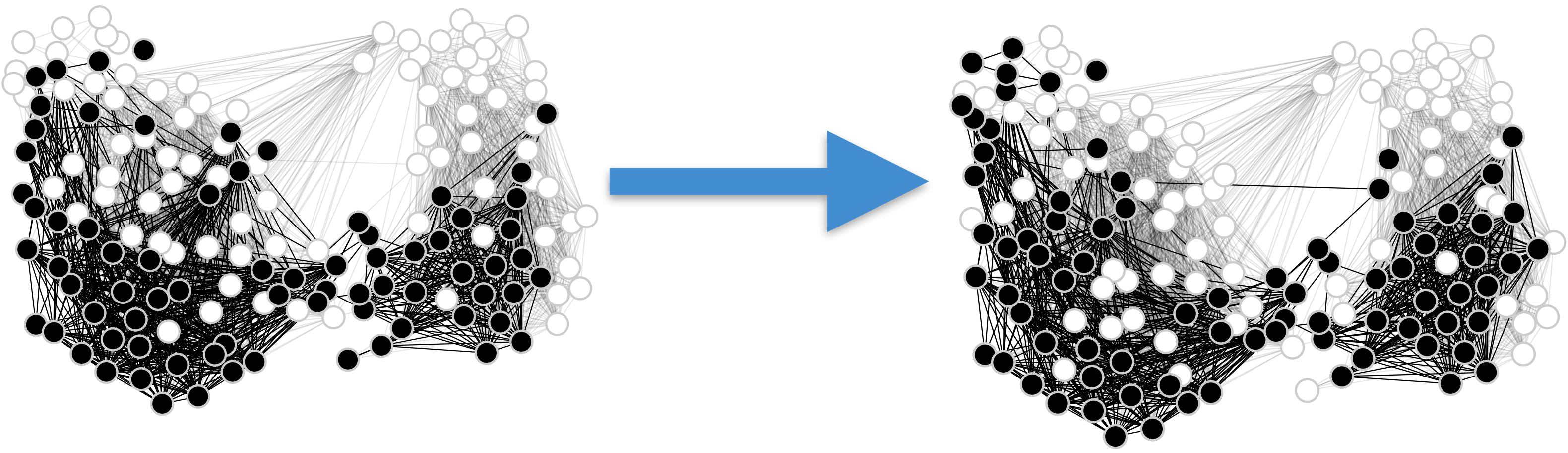
The "hollowing of the middle class"



Science Advances (2018)

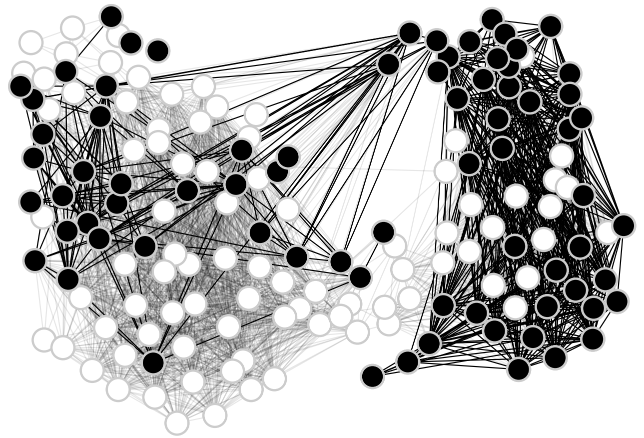
Skill polarization and career mobility

Waitstaff Bartender

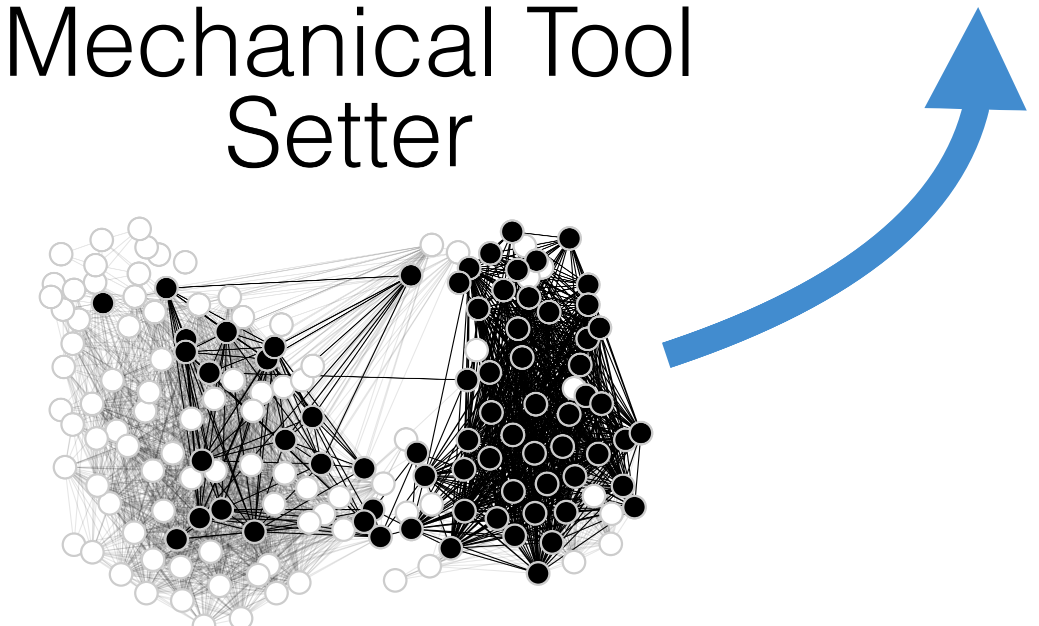


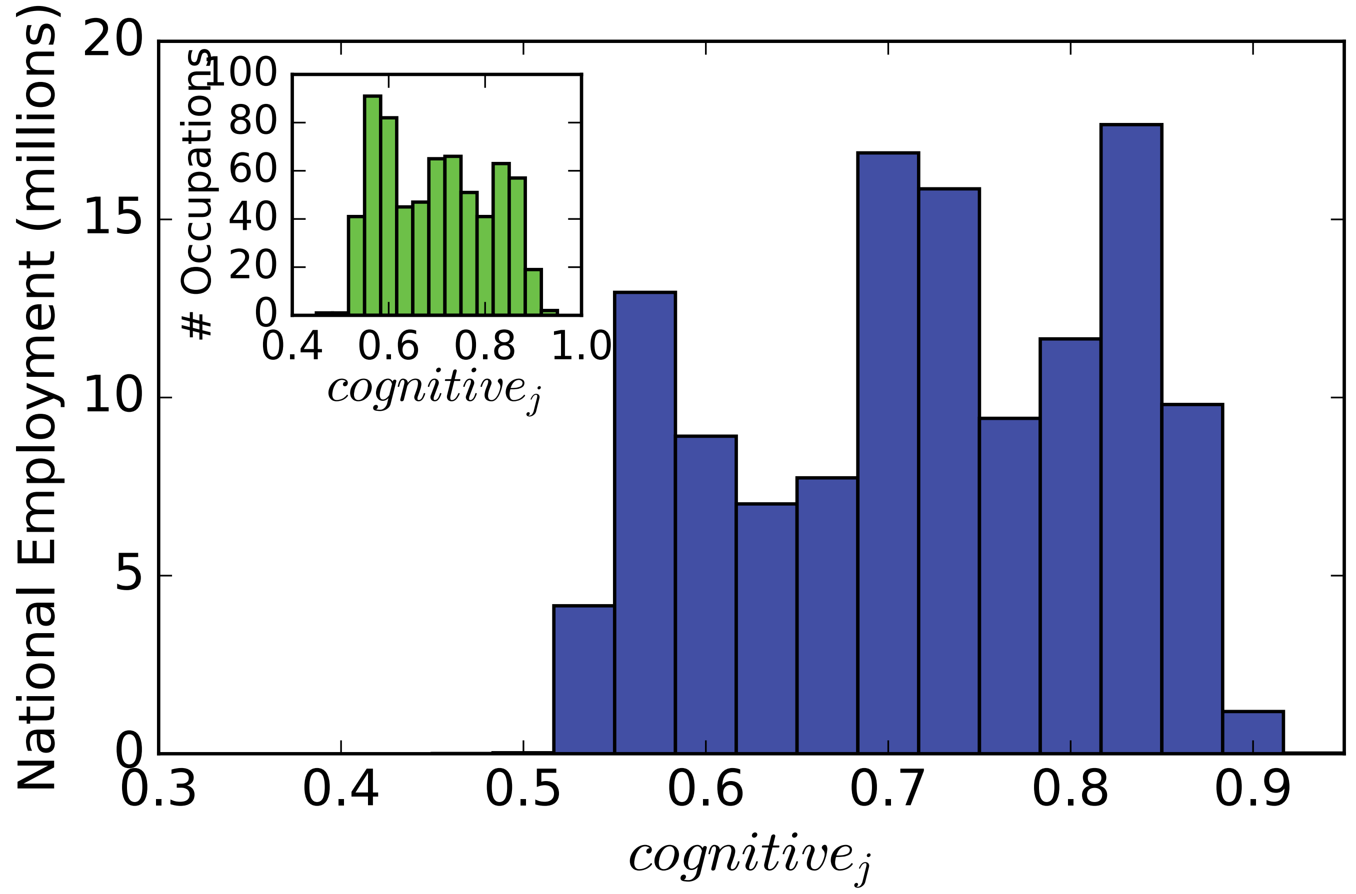
Mid Cognitive Skill

Mechanics Supervisor



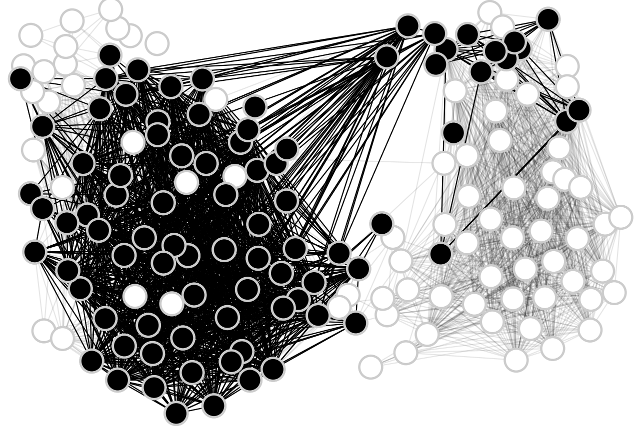
Mechanical Tool Setter



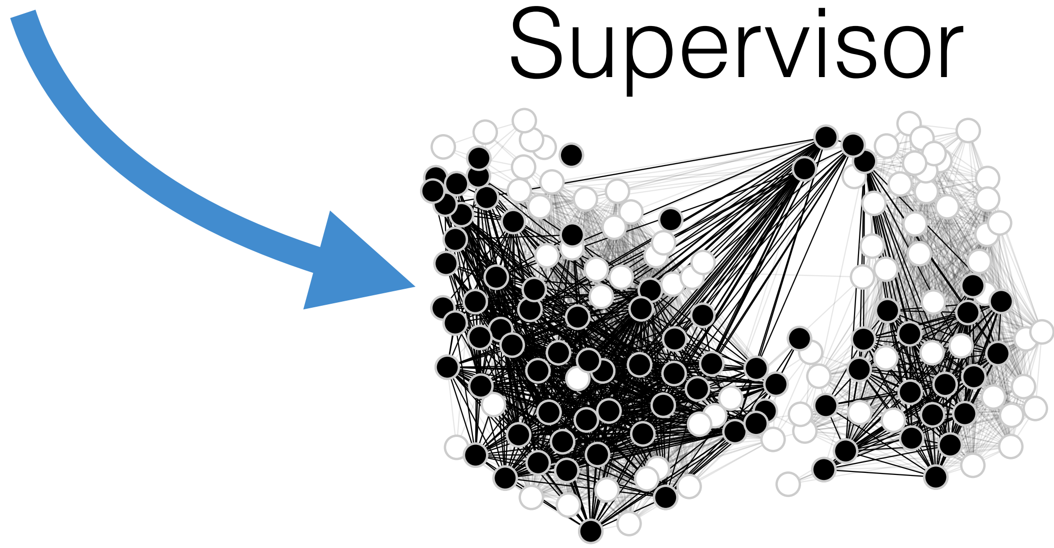


Low Cognitive Skill

Sales Engineer



Retail Supervisor



High Cognitive Skill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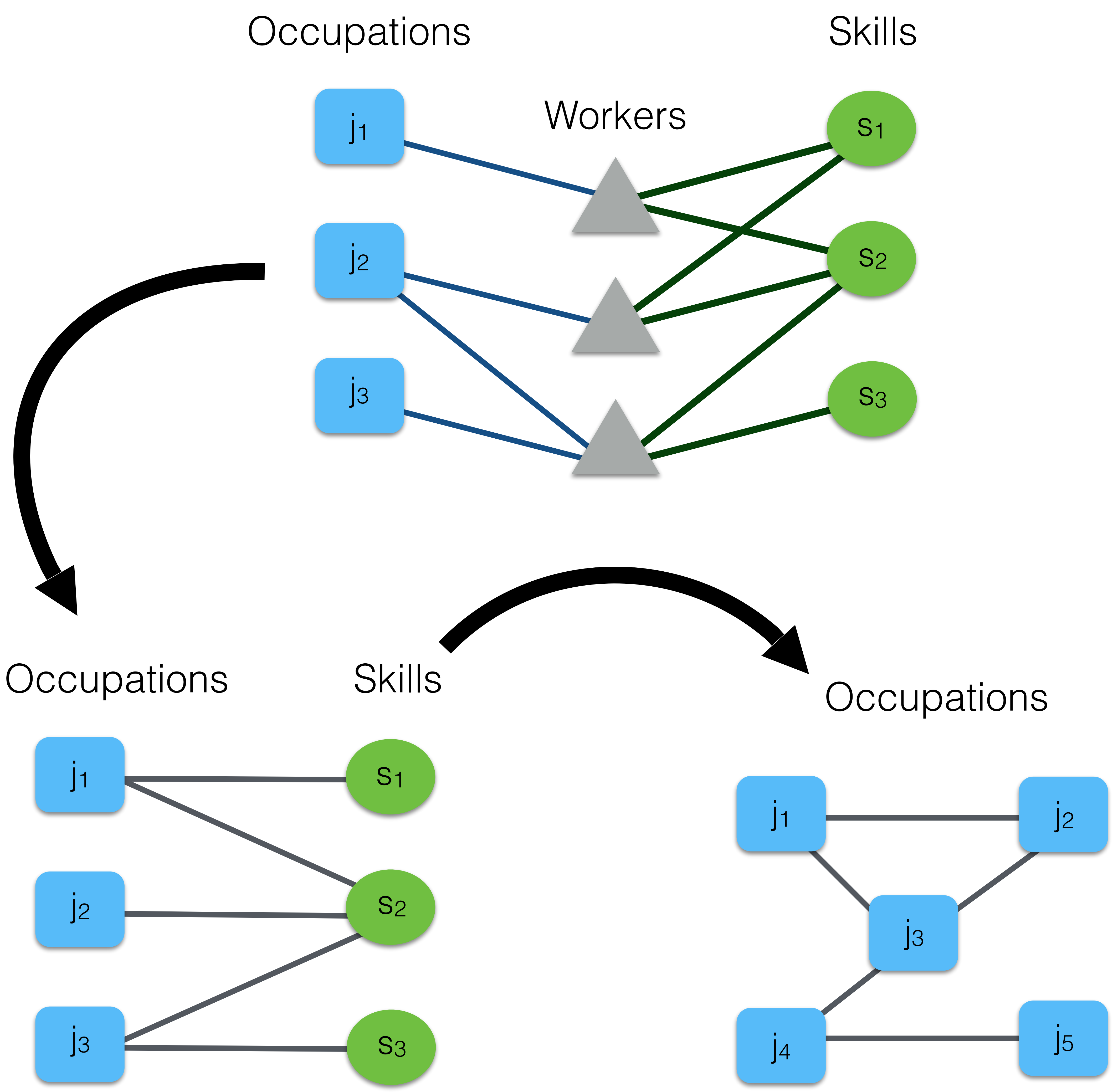
The structure of occupations

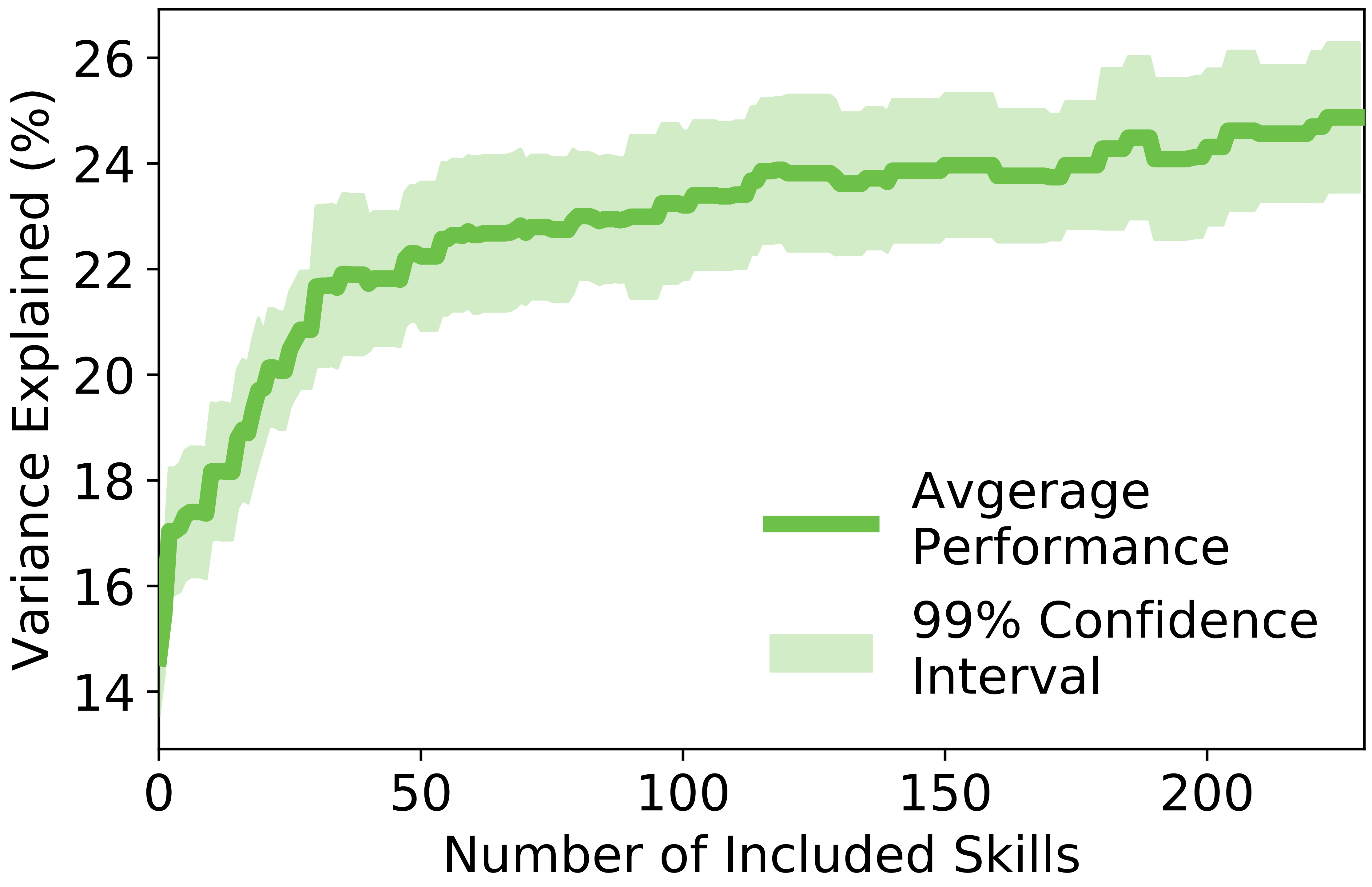


$$rca(j,s) = \frac{onet(j,s) / \sum_{s' \in S} onet(j,s')}{\sum_{j' \in J} onet(j',s) / \sum_{j' \in J, s' \in S} onet(j',s')}$$

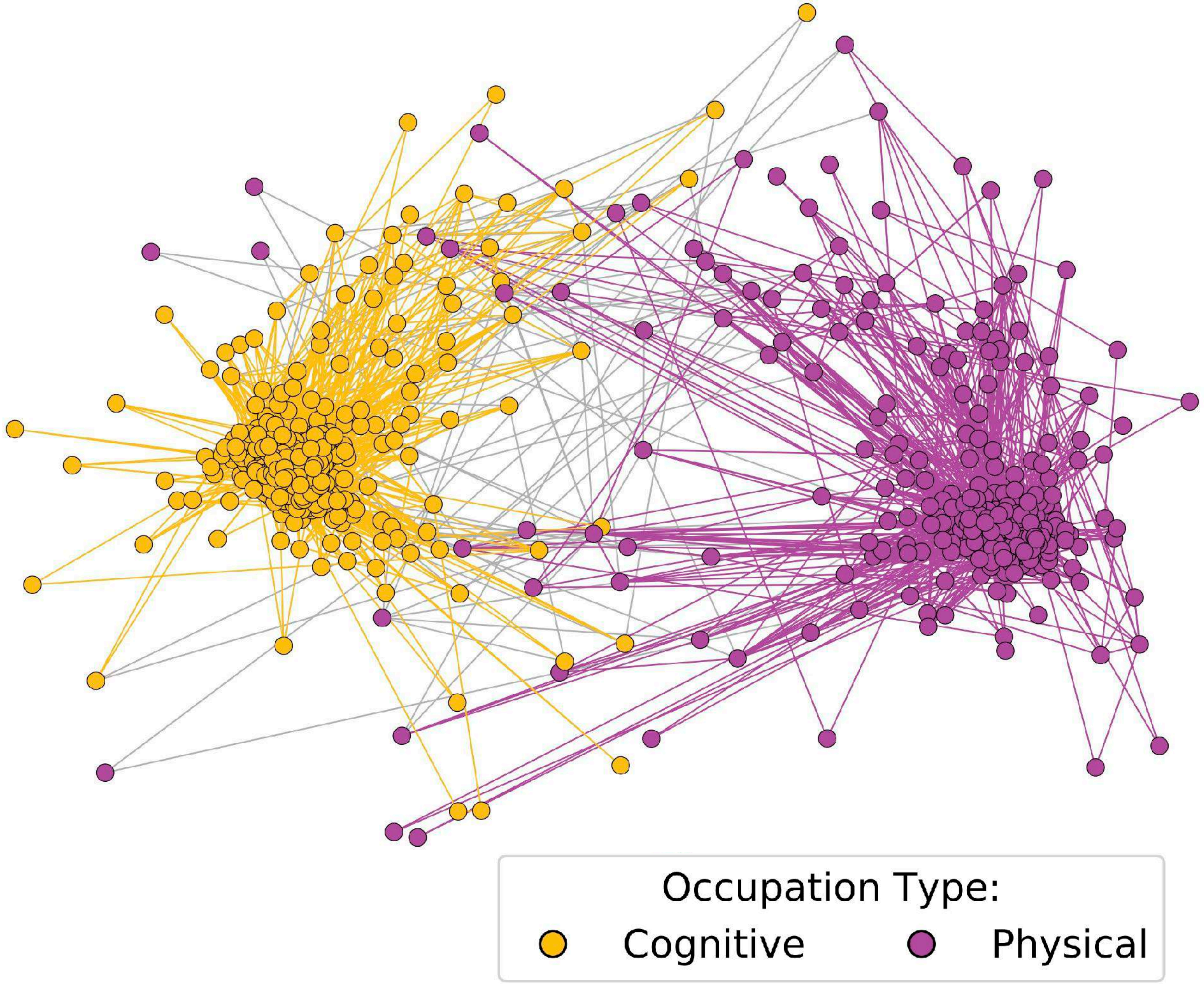
$$I(j,s) = \begin{cases} 1, & \text{if } rca(j,s) > 1 \\ 0, & \text{otherwise} \end{cases}$$

Skill similarity predicts worker mobility

$$skillsim(j,j') = \frac{\sum_{s \in S} I(j,s) \cdot I(j',s)}{\sum_{s \in S} \Big(I(j,s) + I(j',s) - I(j,s) \cdot I(j',s) \Big)}$$



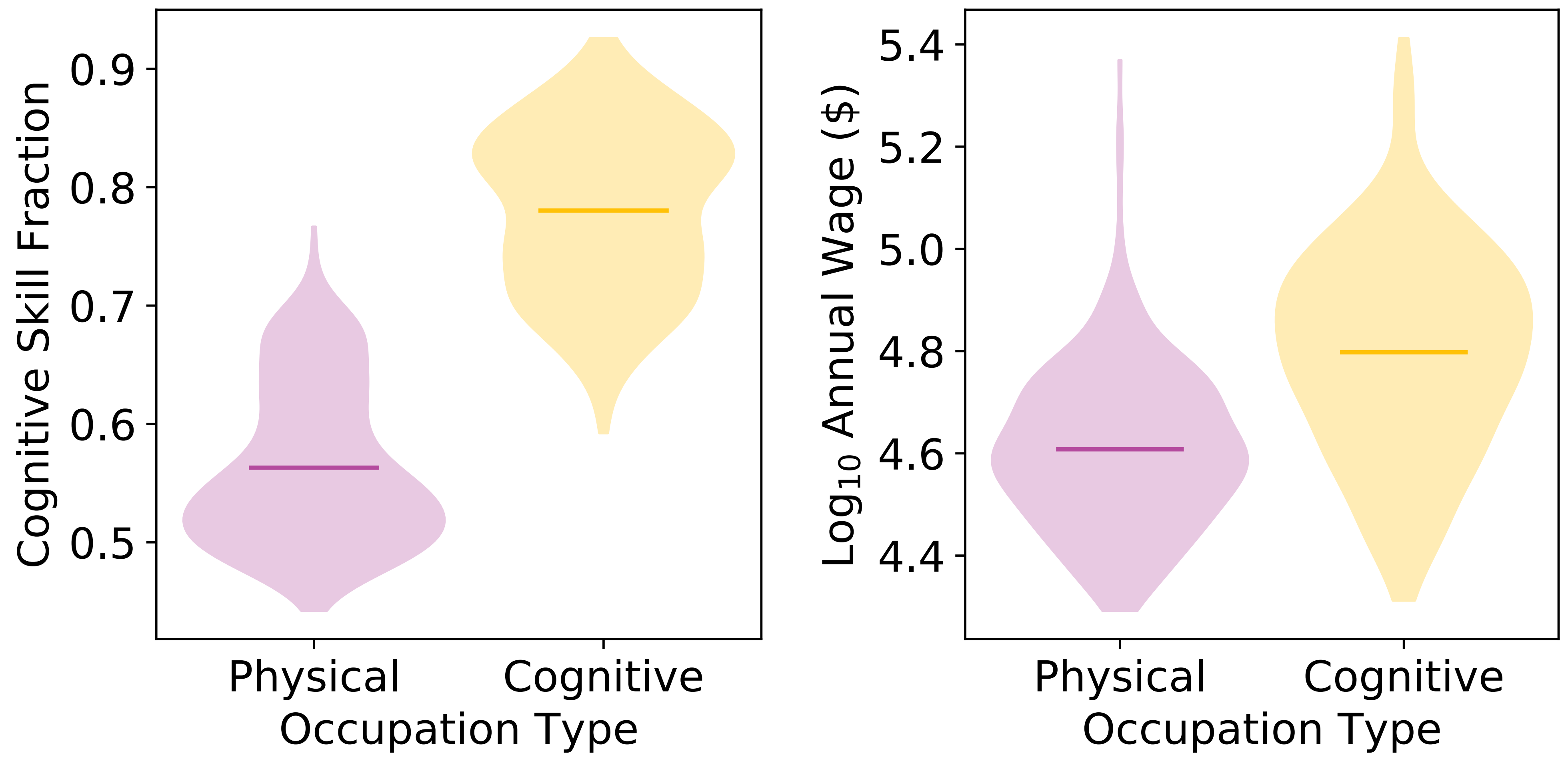
The *polarized* structure of occupations



Example Job Titles:

- Lawyer
- Mathematician
- Software Developer
- Surgeon
- Microbiologist
- Chief Executive
- Statistician

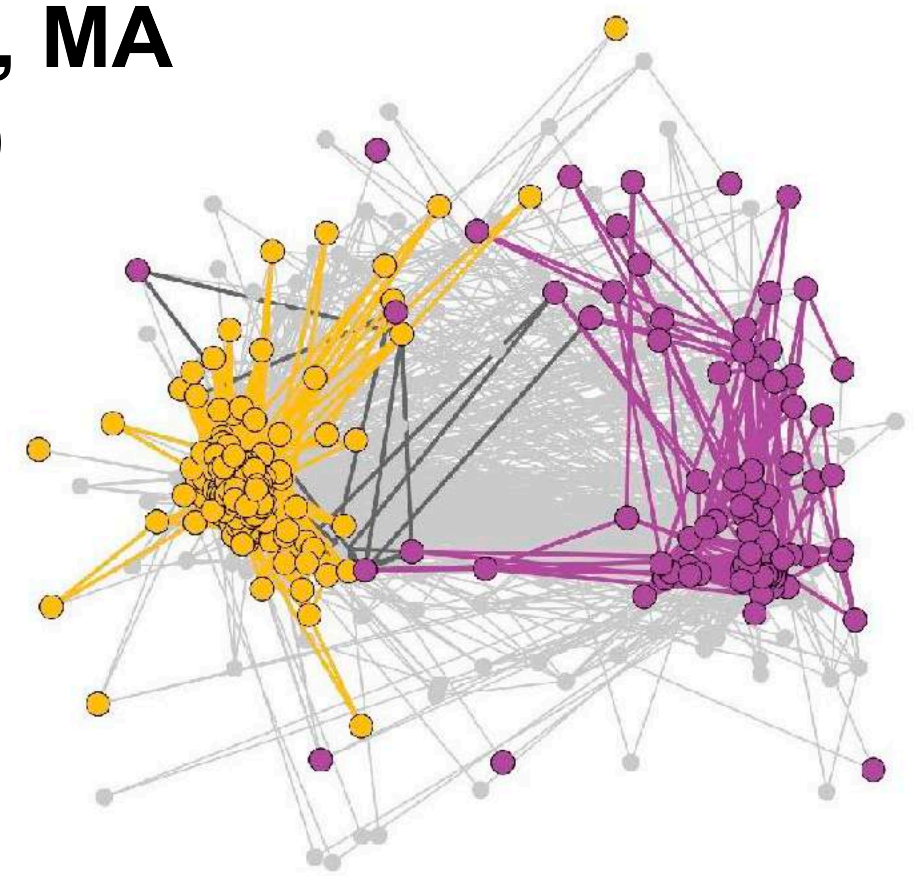
- Bus Driver
- Bartender
- Dancer
- Cook
- Carpenter
- Car Mechanic
- Security Guard
- Janitor



Frank et al., *PNAS* (2019)

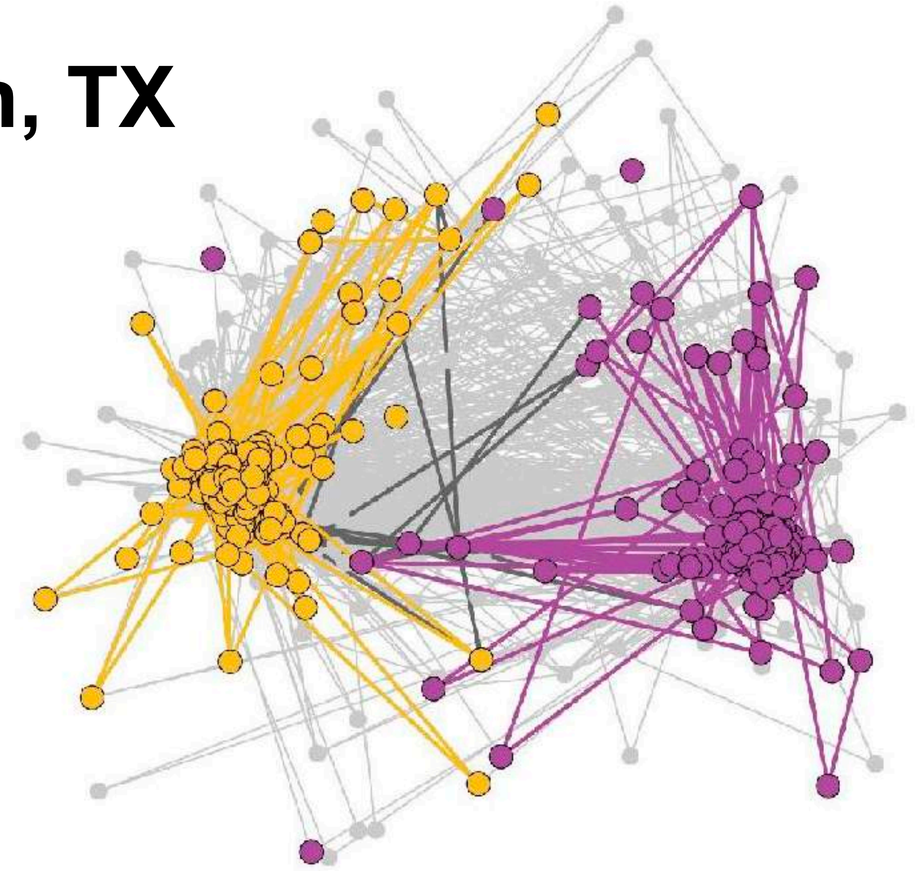
Projecting cities onto the job network

Boston, MA
(N=311)



∩

Houston, TX
(N=317)



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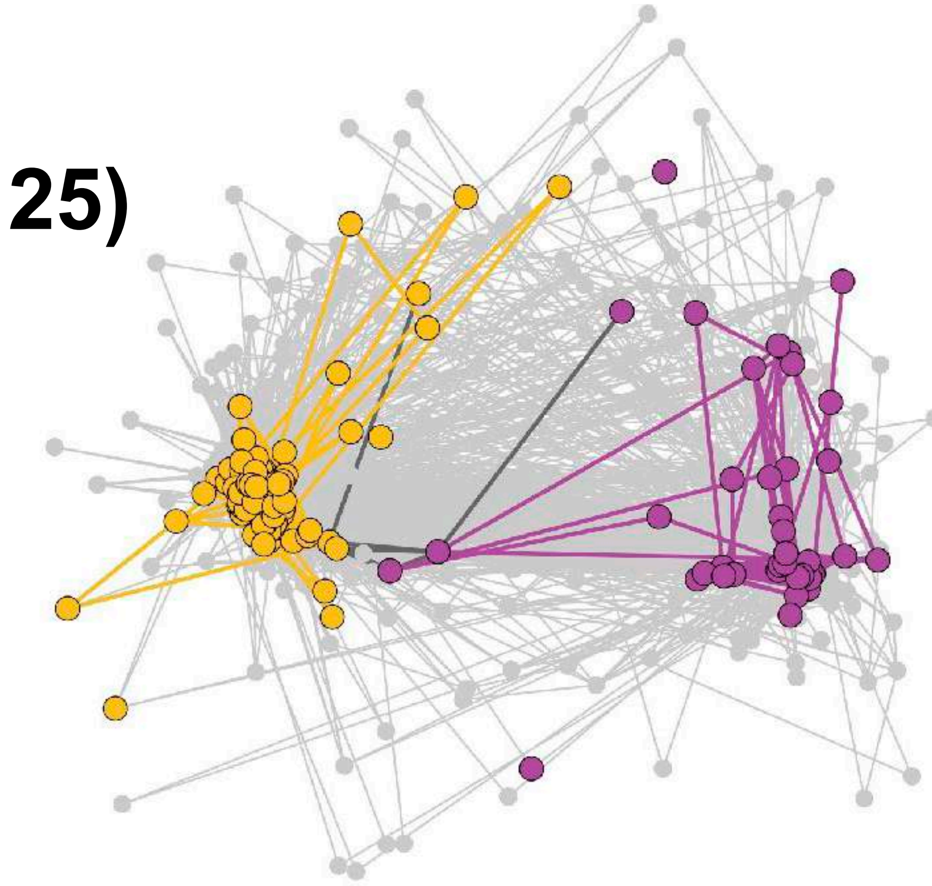
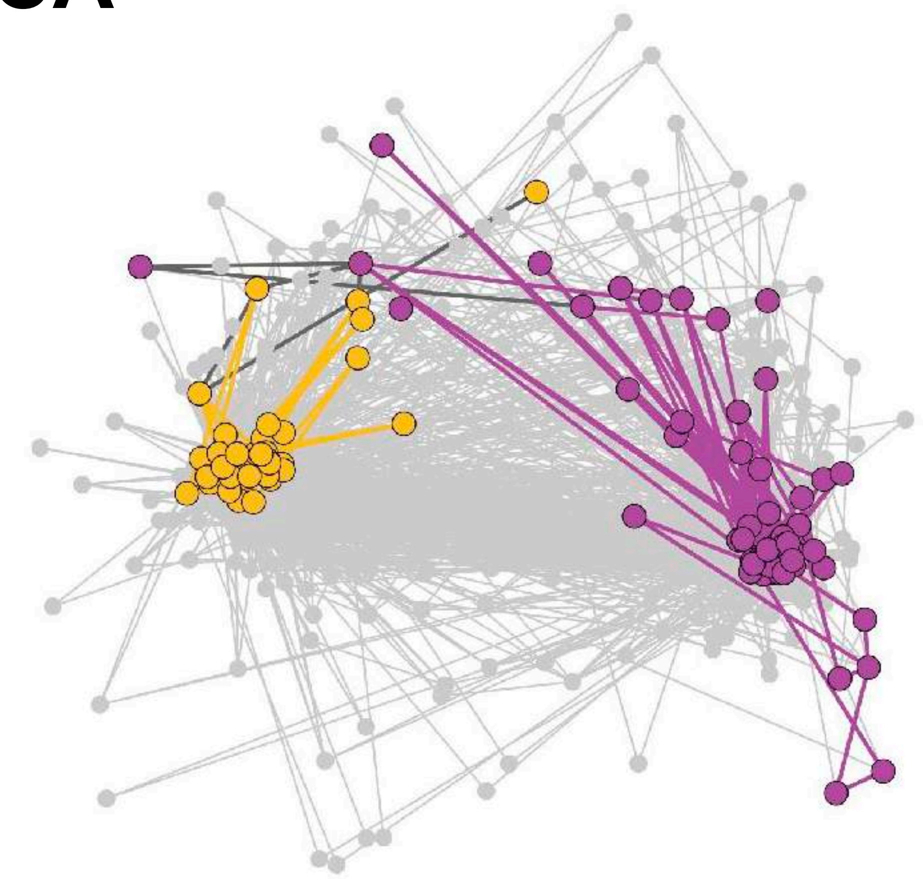
Overlap Network

(N=125)

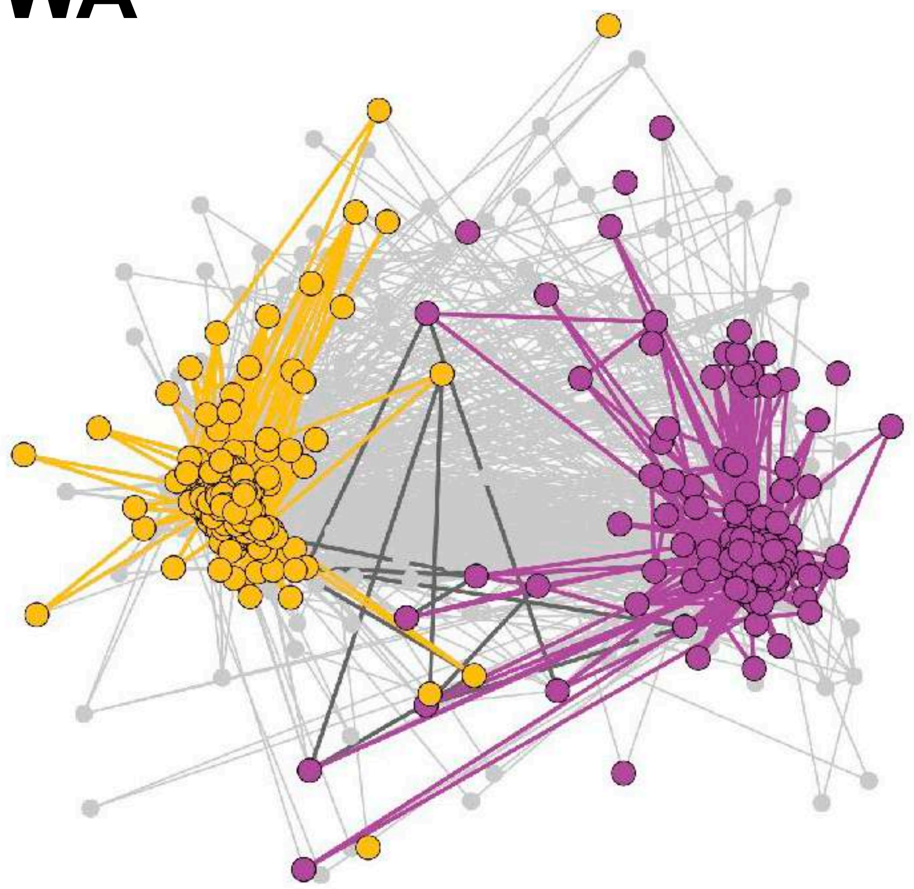


Madera, CA
(N=103)



∩

Seattle, WA
(N=330)



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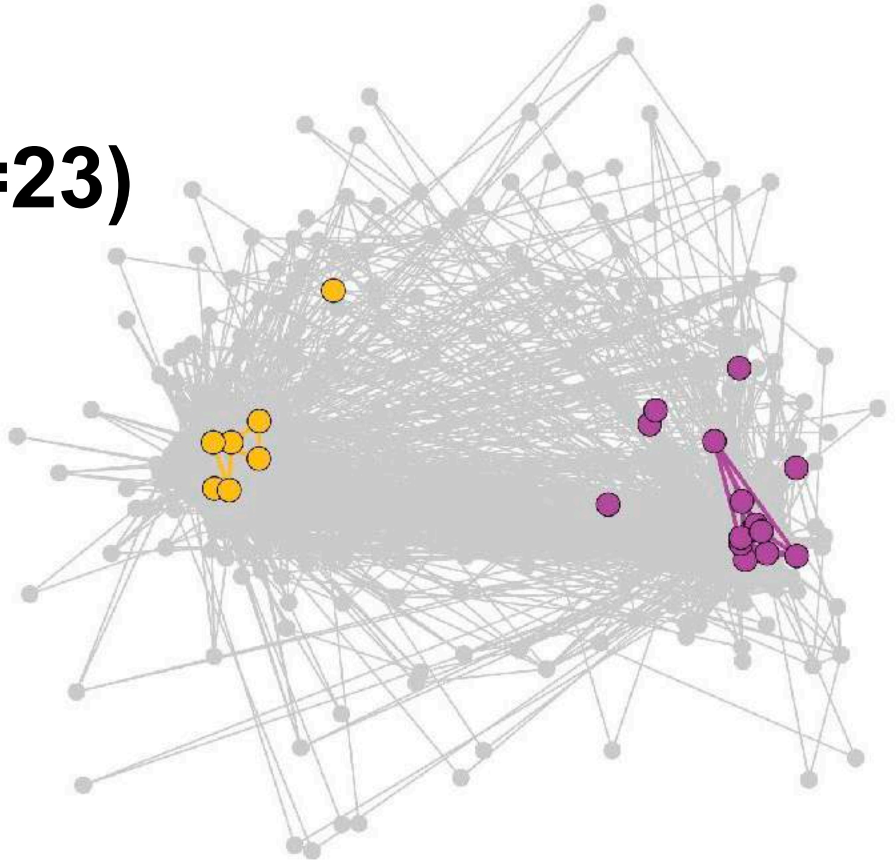
(N=23)



MIT Connection Science
IDSS MIT INSTITUTE FOR DATA, SYSTEMS, AND SOCIETY
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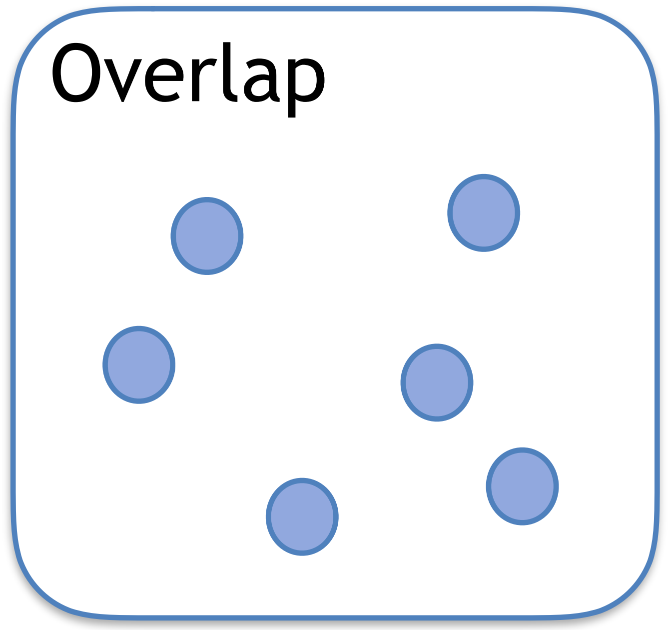
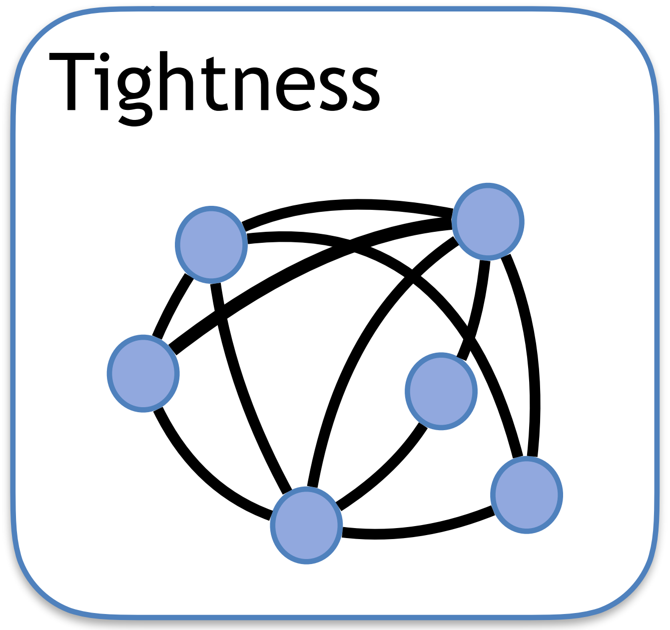
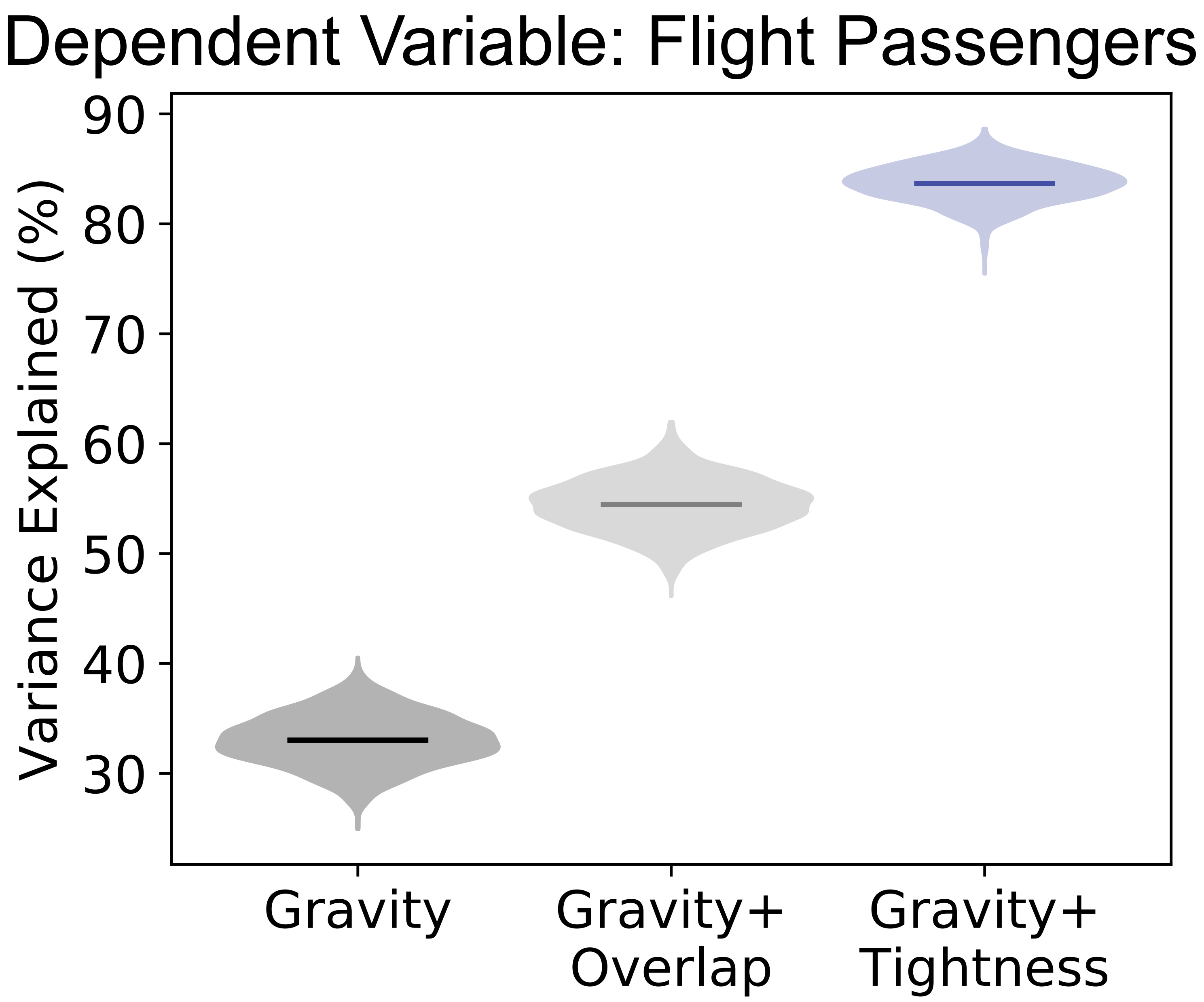
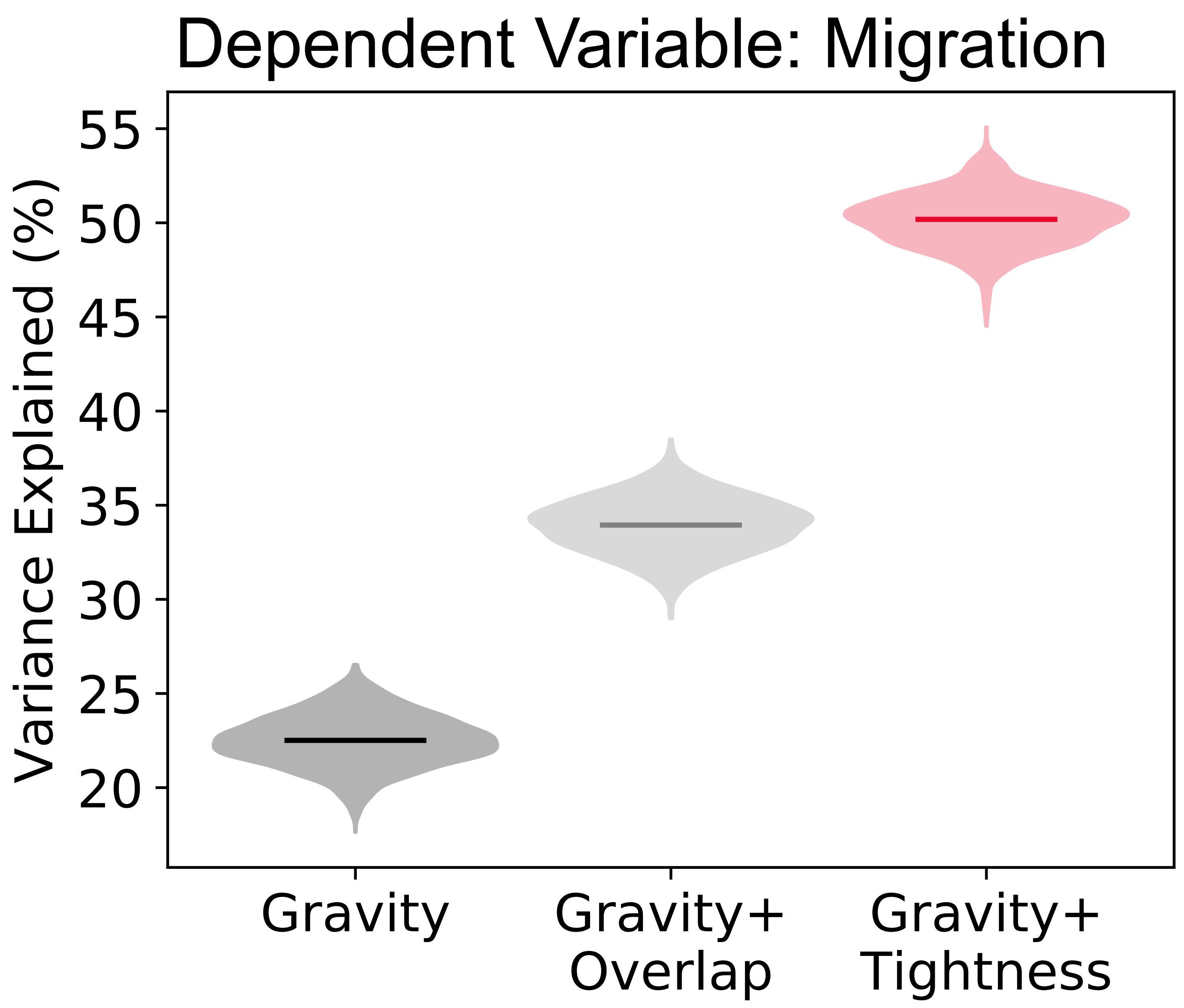
Skills determine spatial mobility





$$tightness(c,c') = \sum_{j,j' \in J^2} \frac{skillsim(j,j') \cdot \big(I(c,j) + I(c',j)\big)}{2 \cdot \sum_{i,i' \in J^2} skillsim(i,i')}$$





Structural economic resilience

- differential impact of automation
- skill & wealth disparity
- spatial career mobility

- career trajectories
- viable retraining
- job polarization

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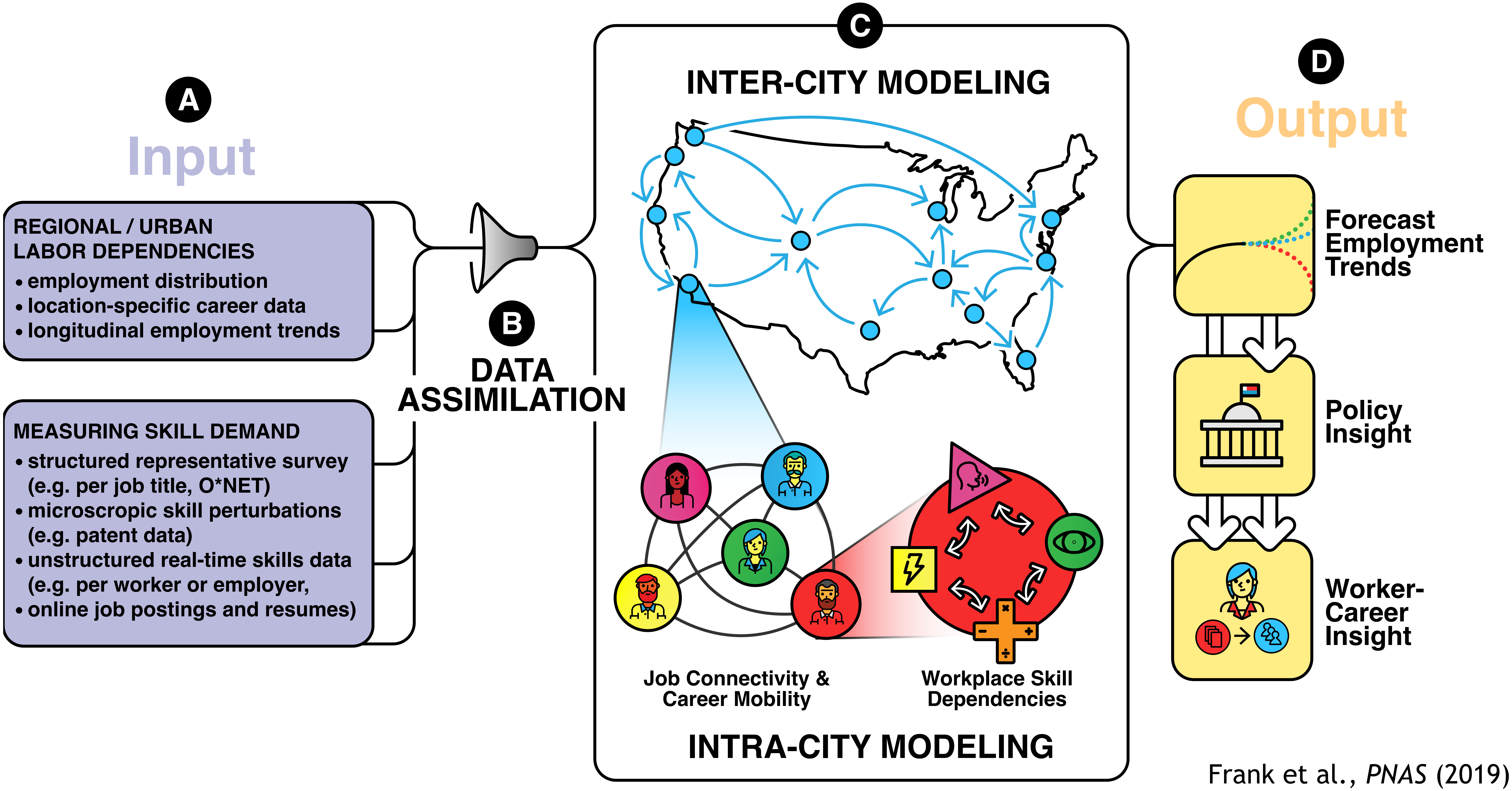
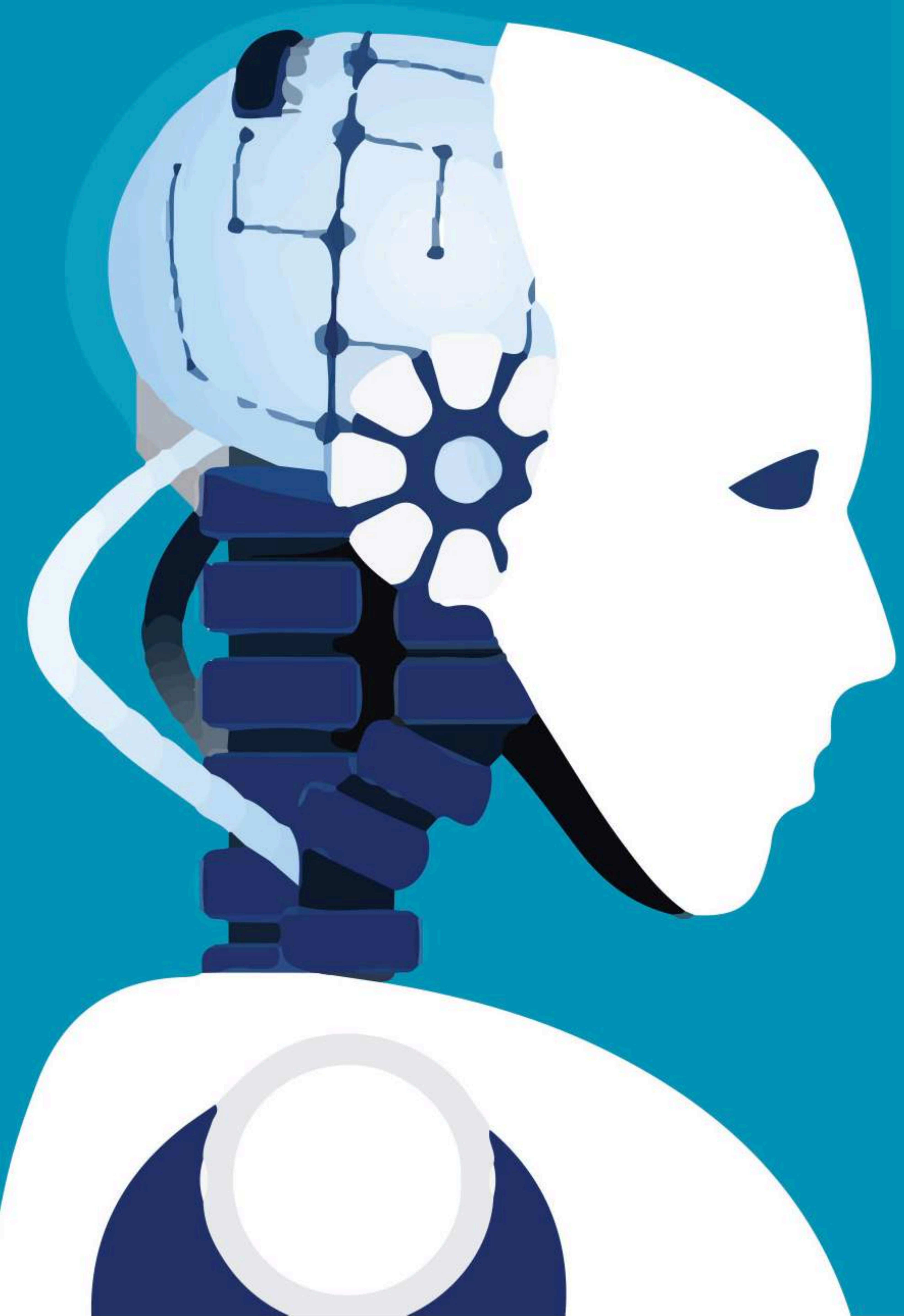


Frank et al., *PNAS* (2019)



- Can retraining programs be more efficient?
- Which workplace activities will be automated?
- What creates economic resilience in cities?
- How can firms maximize returns on investment in technology?